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THE DEVELOPMENT OF MACHINE GUNS.

THE prominent position now accorded to machine guns in naval and military armaments, as well as the increasing interest evinced of late in all matters pertaining to them, might lead to the supposition that they are a comparatively recent production, whereas small-bore weapons of the kind, termed organ guns, were employed by the military as early as the fourteenth century. And yet it requires a great stretch of imagination to treat the organ guns as the prototype of such weapons as the Gatling, Nordenfelt, Gardner, and other modern rifle-caliber guns.

Machine guns have been rapidly developed in the past few years, and the question of naval machine-gun armaments daily assumes increasing importance. The demand for naval machine guns has been brought about partly by the very decided advance effected in their construction — more particularly in regard to those of rifle caliber — and partly by the introduction of powerful torpedo boats. This latter cause has necessitated some special means for affording to the huge and costly iron-clad an effective protection against the attack of boats armed with the Whitehead or other equally destructive torpedo; for the swift and stealthy movements of these craft, and the suddenness of their onslaught, render the ordinary armament of an iron-clad comparatively useless for this purpose; besides, the torpedo boat offers but a small target to the ship's guns even when an attack is made in the day-time. And the creation of a special class of swift cruisers for the protection as well as for the destruction of commerce on the high seas, and the determination of some of the naval powers to enroll, in time of war, the principal steamers of the mercantile marine as ships of war, have together hastened the improvement of the guns.

There are practically three distinct classes of machine guns, viz., those of rifle caliber, firing only rifle bullets; those of one-inch caliber, firing only solid shot; and those of one-and-a-quarter-

inch caliber and upward, which by the Geneva Convention are entitled to fire shells. Thus we have: First, rifle-caliber machine guns, sometimes termed small-bore machine guns, and mitrailleuses. Second, one-inch caliber machine guns. Third, shell machine guns. Of the latter the heavier forms are usually spoken of as "rapid" or "quick" firing guns, for the reason that they are loaded by hand, and not, as in the case of the other weapons, by automatic means, and therefore the expression "machine" is not considered applicable to them.

I purpose to consider separately the employment of machine guns, first for naval and secondly for military purposes. For naval use, the first of the three classes of weapons—rifle-caliber machine guns — must be subdivided into three sections, viz., heavy, medium, and light guns, dependent upon the total weight of the weapon, and not on the number of its barrels. Heavy rifle-caliber machine guns would comprise all such weapons as are of too great weight, and occupy too much space, to be conveniently mounted in the tops of a ship, or in the smaller boats of the vessel, or cannot be moved with ease by men with drag-ropes when employed in shore operations. The Gardner five-barrel, the Gatling ten-barrel, and the Nordenfelt twelve, ten, and seven-barrel guns, are representatives of the heavy rifle-caliber machine guns. Still, the term "heavy" can only be applied comparatively, for the heaviest of the above-named guns—the Gardner five-barrel and the Nordenfelt twelve-barrel—weigh only about two hundred and eighty pounds each, while the seven-barrel gun of the latter system weighs only one hundred and thirty-eight pounds. Medium rifle-caliber machine guns comprise those which can be conveniently placed in the tops and smaller boats of a ship, and which do not require animal transport on shore, but can be drawn or carried by the men of the gun detachment. The Gardner two-barrel and Nordenfelt and Gatling five-barrel guns are representatives of this section. Lastly, are those rifle-caliber machine guns which are exceptionally light, such as the Gardner single-barrel and the Nordenfelt three, two, and single-barrel guns. With the exception of the three-barrel weapon of the latter system, weighing some fifty-six pounds, it is exceedingly doubtful whether any of the guns of this section possess really practical advantages over a good repeating rifle.

Till lately, the Montigny (thirty-seven barrels) and the Gatling (ten barrels) rifle-caliber machine guns were the only

naval weapons of this nature in general use, and practically the only representatives of that class,—the former being employed in the Italian navy, and the latter in the American, English, Russian, and other navies; whilst now we find included in the small-bore, or rifle-caliber class of machine guns, specially devised weapons for the particular work they are required to perform, which have in common the property of great rapidity of fire, and automatic loading, firing, and extracting mechanism.

The vast improvement effected in the construction of machine guns of rifle caliber will be at once apparent from a glance at the following statement: The Gatling ten-barrel gun, above referred to, weighs four hundred and fifty pounds, and its rate of fire for one minute is about five hundred shots; while the Nordenfelt and the improved Gatling ten-barrel guns, weighing each about two hundred and thirty pounds, can fire a thousand shots a minute. Again, the Nordenfelt five-barrel gun, which weighs but one hundred and twenty-eight pounds, has a greater rapidity of fire than the original pattern Gatling ten-barrel gun. Lastly, the Montigny, with its thirty-seven barrels, weighs three hundred and seventy pounds, and fires only three hundred shots a minute,—not so great a rapidity as the Nordenfelt three-barrel gun.

The heavy weapons are intended partly for ship defense and partly for the armament of the small cutters, life-boats, etc., of a man-of-war. The medium weapons would be the most generally useful, as they can be employed for a variety of purposes, but are more particularly intended for mounting in the tops of a ship and for service on shore as naval landing guns. The medium rifle-caliber machine guns would probably form the entire equipment of troop-ships, dispatch vessels, gunboats, and such craft. The light weapons seem to have no actual place in naval machine-gun armaments, unless it be the Nordenfelt three-barrel gun for mounting in the tops of the smaller ships, or as an exceptionally light and handy landing gun. The necessity for the employment of a weapon such as the heavy or medium rifle-caliber machine gun, in modern naval warfare, results from the fact that the crews of even our largest men-of-war are numerically very much weaker than those of the line-of-battle ships of twenty years ago. And though, as far as iron-clads are concerned, no deliberate attempt to board may be made, yet, owing to the introduction of the ram, this function

of naval warfare will often be rendered obligatory by two ships, which have failed in an attempt to ram, falling aboard and becoming locked together. In such case the success of an attempt to board by one or other of the ships' crews will depend in a great measure on the actual power of rifle fire that can be brought into play to sweep a clear passage for the first rush of the boarders.

In future naval engagements, whether between fleets or single ships, the ram will form the principal engine of attack, thus affording to the rifle-caliber machine gun every opportunity for proving the effectiveness and the deadly nature of its fire, by sweeping an enemy's decks, and pouring into her gun-ports and tops a hail of rifle bullets, and by discharging volley after volley against the conning towers, in the probability that one or more of the bullets will pass through the loop-holes or directing-ports and kill, wound, or at least distract the attention of, the officers and men confined therein to such a degree that at the critical moment the enemy may be placed in a position favorable to being rammed, or, on the other hand, prevented from delivering her ram attack with any chance of success. Then, as the armament of the smaller boats of a man-of-war, the rifle-caliber machine gun, both heavy and medium, is exceedingly effective, whether for covering the debarkation or embarkation of troops or naval brigades, for expeditions necessitating the penetration of an enemy's country by river, for cutting-out expeditions, for capturing slave vessels, or for other boat service. For naval landing purposes the medium rifle-caliber machine gun is particularly adapted, as this service usually requires a weapon possessing considerable rapidity of fire — so as to counterbalance, as far as possible, the numerical weakness of naval parties employed on shore — and capable of being dragged with the greatest facility over rough ground by a few men.

We now come to the consideration of the class of machine guns that, though having a much larger caliber than those previously treated of, are not permitted by the Geneva Convention to fire other than solid shot. Those powers that have not subscribed to this Convention are at liberty to use any kind of ammunition, no matter what the caliber of the weapon may be. But, apart from the fact that such a mode of warfare would be condemned by all civilized nations as unfair and barbarous, no practical object is gained by the use of very small shells,

such as would have to be discharged from weapons having a caliber of one inch and under, while considerable danger would attend the firing of such small-bore machine guns at the high rate of discharge common to them, if any kind of shell ammunition were employed. Next are the machine guns of one-inch caliber, now represented by the Nordenfelt four-barreled and two-barreled one-inch guns; the former, usually termed anti-torpedo-boat guns, being expressly intended for the defense of ships against the attack of torpedo boats, while the latter are employed by England, Italy, and other powers, as the armament of torpedo boats.

This brings us to one of the most important problems of modern naval warfare, viz., the most effective manner in which to provide ships of war with a defense against the attacks of torpedo boats armed with the formidable Whitehead torpedo, or some other similar weapon of offense, such as the Harvey, rocket, or spar torpedo. Numerous devices have been proposed from time to time, but a special form of machine-gun armament promises to meet the requirements better than any other contrivance that has yet been discovered. This remark applies more particularly to vessels under way, for rarely should a fair opportunity be accorded to the torpedo boat for making an attack on a vessel at anchor. Should circumstances force the ship to place herself in such a position, then of course some external means of protection, such as nets, booms, guard-boats, etc., must be resorted to; and whether she is under way or at anchor, the electric light will, of course, be employed with considerable advantage.

The vast importance of this question has been very generally admitted by the naval powers, with the result that during the past three or four years numerous and exhaustive experiments have been instituted in Europe and elsewhere, for the purpose of obtaining the most effective anti-torpedo-boat machine gun; and thus we now find either the Nordenfelt four-barreled one-inch gun or the Hotchkiss five-barreled thirty-seven-millimeter (about an inch and a half) shell gun forming a component part of the armament of most ships of war, especially the iron-clads. These weapons, though intended for the same work, differ so very materially that it may be interesting to note the points special to each. The Nordenfelt fires only solid shot; the Hotchkiss, solid or shell projectiles. The former can discharge

either single shots or volleys of four shots, while the latter can only fire single shots. The Hotchkiss is a revolving cannon, and has rotatory crank motion, while the Nordenfelt's barrels are fixed and in the same horizontal plane, and its firing-lever has a forward and backward movement. Lastly, the Nordenfelt is elevated and trained by screw gear provided with wheels, while the Hotchkiss is aimed by means of a shoulder-piece. Which of these weapons is best suited to the purpose of providing ships with an efficient defense against the attack of torpedo boats, is a question involving too many technical considerations to be discussed in this paper; and besides, this matter has become still more complicated by the recent construction of a Nordenfelt double-barreled one-and-a-half-inch shell gun. Thus the problem to be solved is not alone that of slow-firing shell machine guns, as compared with solid-shot rapid volley-firing machine guns, but further, whether a double-barreled shell machine gun, capable of firing volleys of two shots, is preferable to the former style of weapon.

It was erroneously supposed, when this question was first considered, that the Hotchkiss gun combined the functions of an anti-torpedo-boat weapon and those of an ordinary naval shell machine gun; but now these functions are seen to require each a special kind of machine gun, for otherwise the essential features of the former weapon—rapidity of discharge and volley fire—must be sacrificed to the essential features of the latter weapon—great penetrative power, or *vice versa*. Suffice it to say, that either of these machine guns, if properly handled, will render the torpedo-boat attack a service of extreme difficulty and danger.

The experience of the Chili-Peruvian war, as well as the fact that torpedo boats are now increasing both in number and size, necessitates their being equipped with some kind of gun defense. This has led to the construction of the two-barreled one-inch machine gun, power, rapidity of fire, lightness, compactness, etc., being its leading features. At the same time, an especially light single-barreled shell machine gun is preferred by some for this work, and in a few instances a rifle-caliber machine gun has been adopted for the torpedo-boat armament.

The next subject for consideration is the introduction of light and heavy rapid-firing single-barreled shell guns. The weapons that now form the light naval armament have a

great many objectionable features; in fact, are in no particular qualified for the work they are intended to be used for. These guns, which vary but slightly in all navies, are cumbersome, and have small penetrative power, a comparatively low degree of accuracy, and an exceedingly slow rate of discharge; while the class of rapid-firing shell guns affords an exceedingly powerful and effective naval armament, whether for use in ships, in boats, or on shore, as the features of considerable penetrative power, high degree of accuracy, rapidity of fire, and handiness are common to them; besides which, this class of weapon has the advantage of using the made-up cartridge. Comparing the ordinary naval light gun with the rapid-firing shell gun, there is to be found only one point of superiority on the side of the former, viz., the discharge of heavier and larger shells, which means a greater number of splinters, more effect, and larger area covered by the bursting of a shell projectile of the former weapon, when compared with the bursting of a similar projectile fired from the latter gun. However, this advantage only remains when shell for shell is compared; for if we suppose both the weapons to fire for a certain period of time, then this point of superiority for the present naval light gun will not be sustained. A six-pounder rapid-firing shell gun discharges, when aimed between each shot, twelve projectiles in one minute, while an ordinary naval twelve-pounder gun can only fire at the rate of two shots a minute. Thus, in firing continuously for one minute, the latter would discharge two projectiles, equivalent to twenty-four pounds of metal, or seventy-five shell splinters, or one hundred and seventy-six shrapnel bullets. The six-pounder rapid-firing gun would, in the same time, discharge twelve projectiles, equivalent to seventy-two pounds of metal, or four hundred and eighty shell splinters, or five hundred and eighty-eight shrapnel bullets; and the total area of destructive effect produced by these twelve six-pound shells or shrapnels would be considerably greater than in the case of the two twelve-pound shells. The continuous bursting of shell or shrapnel discharged from the rapid-firing shell guns, amongst a body of troops, would prove most serious.

The penetrative power of these rapid-firing guns is exceedingly high for their small caliber; for instance, one of them of one-and-a-half-inch caliber (Nordenfelt) during some recent official experiments in Brazil, effected a greater penetration

in a solid two-inch iron plate than a nine-pounder three-inch gun at the same range. The unarmored cruiser of the present time, with its thin steel or iron sides, can be perforated by the two-pounder, three-pounder, and six-pounder rapid-firing guns, at respectively twenty-four hundred yards, thirty-three hundred yards, and forty-five hundred yards, and these weapons fire with ease from twelve to fifteen aimed shots a minute. There is yet another advantage to be gained by the introduction of this class of machine guns, which is, that they can be arranged to be fired from a naval landing carriage without causing it to run back; and thus, by this absence of recoil, shell after shell can be discharged in rapid succession, with but slight derangement of aim. If the target presented be a body of men, as would, of course, be always the case, a very small variation in the aim is rather advantageous than otherwise, as by this means the shells are spread instead of being dropped close together, thus enlarging the destructive area. With the ordinary naval light gun, mounted on its landing carriage, each shot causes the carriage to run back or recoil several feet, thus adding another factor adverse to rapid firing; the others being the separate loading of cartridge and projectile and the necessity of sponging, all of which are absent in the system of rapid-firing shell guns, where only one operation, that of loading by hand, without rammer, is required.

Very little progress has been made in the employment of machine guns in field service, but there is a growing and decided tendency on the part of the military authorities to look with favor upon their use. The celebrated Russian General Skobeleff always advocated their employment, though his experience of such weapons was confined to the old pattern of rifle-caliber machine guns; and Generals Lord Wolseley and Lord Chelmsford have expressed themselves very strongly and decidedly in favor of their adoption; while on the continent several papers have been read by military officers on the same subject. The main objections hitherto urged against the introduction of rifle-caliber machine guns into the military service, even for experimental purposes, have been entirely based on the failure of the French mitrailleuses; but this failure occurred fourteen years ago, before any of the more important improvements in machine guns were made, and it should no longer operate prejudicially. Yet another cause which has tended to

prevent the introduction of rifle-caliber machine guns has been the powerful opposition of the artillery, due in a great measure to an unreasoning and exaggerated fear that these weapons, if introduced, would threaten the very existence of the field artillery; but now that those who advocate the employment of this arm have forsaken their mistaken policy of pitting rifle-caliber machine guns against field guns, and the actual purpose of the weapons has at last been grasped, a decided reaction in favor of their employment in the field is evident. The object of rifle-caliber machine guns, as at present constructed, is to provide either of the other branches of the military service with an exceedingly powerful rifle fire, by means of weapons having the property of mobility in the highest degree. Such pieces should be treated as merely a cluster of rifle-barrels so arranged as to afford a greater power of rifle fire than is possible to be obtained from a similar number of rifles in the hands of soldiers, while capable of being moved with as great facility over any ground as infantry, and requiring but two or three men for their operation. In a few words, the use of rifle-caliber machine guns offers to a general the simplest and most effective means whereby to intensify rifle fire at any point of his position, without causing the offensive or defensive power of any other part to be weakened for this purpose.

Rapid-firing single-barreled shell guns possess some exceedingly important features for the military service, whether used in the field, as mountain guns, or for the armament of fortifications and earthworks. The properties that most strongly recommend these guns for service in the field are rapid fire, little or no recoil of gun-carriage, mobility, simplicity of mechanism and manipulation, and, lastly, the use of made-up or self-contained cartridges. It is difficult to conceive of more suitable guns for light horse artillery. Take, for instance, a battery of six rapid-firing three-pounder shell guns, each capable of discharging eight projectiles in half a minute, with deliberate aim between each shot. A battery of this nature could in this short period of time deliver forty-eight projectiles, equivalent to one hundred and forty-four pounds of metal; and if common shells were used, with one thousand four hundred and forty splinters, or for shrapnel shells, with two thousand and sixteen lead bullets. Such a rain of bursting shells would create terrible con-

fusion, and have a most demoralizing and destructive effect if thrown amongst a body of troops; while if directed against earth-works or houses, the continuous fire of shell after shell would soon produce considerable damage. The comparative lightness of these weapons would permit of their being provided with an effective shield protection without reducing to any serious extent their property of mobility; besides, the additional weight of this shield would permit of a larger powder charge being used, with a corresponding increase in initial velocity, accuracy, and power. Three-pounder guns have been referred to, but six-pounders are also adapted for field service, by allowing them to recoil and automatically return to their original positions without causing their carriages to run back.

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